3D Printing STL files: A step-by-step guide

Written by Ken Giang

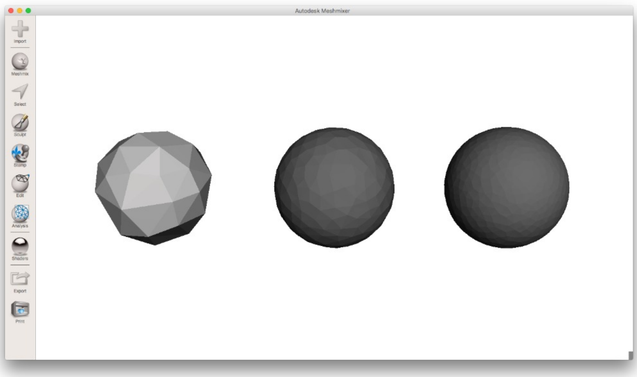
Learn how to avoid low quality prints or unnecessarily large 3D files by exporting your STL file in the correct resolution.

Introduction

While there are a number of file types that 3D printers use to convert 3D models into a 3D print (.OBJ, .3DP etc), .STL (standard triangle language) has become the industry standard and is the most commonly used file type by a large margin. Most CAD software will allow any 3D model to be exported as an STL file which can then be converted into G-code (a process called "slicing") for a 3D printer to interpret and print.

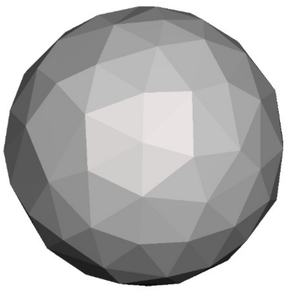
Step 1. Understanding the importance of STL export resolution

The STL file format uses a series of linked triangles to recreate the surface geometry of a solid model. When increasing the resolution (and size) of your file, more triangles are placed on the surface of the model.



A sphere rendered in three different resolutions in MeshMixer

When the resolution of your file is too low, your 3D print includes visual triangles on the surface. A resolution that is too high leads to an unnecessarily large file and can contain details that cannot be 3D printed.

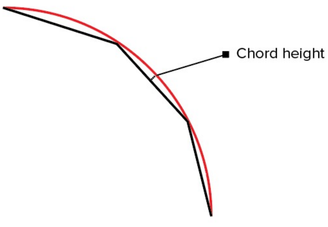


A low resolution sphere: The triangles are affecting the shape

Step 2. Choosing the right resolution when exporting

You can change the resolution by altering the tolerance in your CAD package. Each CAD package has a different way of specifying this but most of them include chord height and angle control.

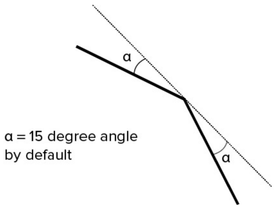
The chord height is the maximum distance from the surface of the original design and the surface of the design in STL format. The smaller the chord height, the smaller the facets and the more accurately the curvature of the surface is represented.



A visual illustration of chord height

It's recommended to choose a 0.001 millimeters chord height. This always results in a good export. Exporting with a tolerance smaller than 0.001 mm won't increase the quality of your print because printers are not able to print in that detail.

Angular tolerance limits the angle between the normals of adjacent triangles. The default setting is often 15 degrees. Reducing the angle will increase the resolution of the STL file.



A visual illustration of angular tolerance

The setting can be between 0 and 1. Unless a higher setting is necessary, to achieve smoother surfaces, 0 is recommended.

Step 3. Exporting STL files from your CAD program

All CAD programs have their own way to export STL files. Instructions on exporting STL files with a range of CAD programs can be found here.

Rules of thumb

- Export with a 0.001 millimeters chord height tolerance.
- Follow the export instructions for the CAD program you are using.
- Upload your STL file and we'll auto-fix small geometry imperfections.

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Ken's Hub – (Industrial) Designer working with 3D printers; mainly focussed on making prototypes and proof of concepts.